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FITCH EVEN TABIN AND FLANNERY
120 SOUTH LA SALLE STREET
SUITE 1600
CHICAGO, IL 60603-3406

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/535,526	NAKAMURA ET AL.
	Examiner	Art Unit
	LI LIU	2613

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 May 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-45* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *40,41 and 43-45* is/are allowed.

6)☒ Claim(s) *1,3-7,9-12,14-18, 20-24, 26-28 and 46* is/are rejected.

7)☒ Claim(s) *2,8,13,19,25,29-39 and 42* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/18/05, 9/26/06*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 5/18/2005 and 9/26/2006 are being considered by the examiner.

Claim Objections

2. Claims 2-11, 13-39, 41, 42, 44 and 45 are objected to because of the following informalities:

1). In line 1 of the respective claims 2-11, 13-39, 41, 44 and 45, "**An** optical wavelength division multiplexing access system" should be changed to "**The** optical wavelength division multiplexing access system".

2). Claim 42, page 23, line 2-3, "for multiplexing downstream optical signals having wavelengths λdk+1 to λdn for transmission along said downstream redundant optical fiber" should be changed to "for multiplexing downstream optical signals having wavelengths λdk+1 to λdn for transmission along said downstream redundant optical fiber <u>to said ONUs #1 to #k</u>"; line 5-7, "for multiplexing downstream optical signals having wavelengths λd1 to λdk for transmission along said downstream redundant optical fiber" should be changed to "for multiplexing downstream optical signals having wavelengths λd1 to λdk for transmission along said downstream redundant optical fiber <u>to said ONUs #k+1 to #n</u>", since the Fourth Embodiment clearly states "At this time, the wavelengths λd1 to λdk for the current use and the wavelengths λdk+1 to λdn as reserves are allocated to the ONUs #1 to #k, and the wavelengths λdk+1 to λdn for the

current use and the wavelengths λd1 to λdk as reserves are allocated to the ONUs #k+1 to #n" (page 47, line 18-22).

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 3, 11, 14 and 26-28 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

1). Claims 3, 14 and 26, and thus depending claims 27 and 28, recite the limitation "k is an integer of one or greater to smaller than n". It is not clear how the k is defined.

2). Claim 11 recites the limitation "said means that individually detects a transmission cutoff of upstream optical signals from said ONUs" in line 3-4. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 3, 4, 7 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al (US H2075) in view of Gerstel et al (Gerstel et al: "Optical Layer Survivability-An Implementation Perspective", IEEE Journal on Selected Areas in Communications, Vol. 18, No. 10, October 2000, pages 1885-1899) and Han et al (US 2004/0213574).

1). With regard to claim 1, Gnauck discloses an optical wavelength division multiplexing access system (e.g., Figure 4), whereby a center node (OSU) (the CO 410 in Figure 4) and n optical network units (ONUs) (e.g., the ONU 470 in Figure 4) are arranged by using a W-MULDEM unit (e.g., the AWG in RN in Figure 4), whereby a multiplexing section between said OSU and said W-MULDEM unit is established by extending a current-use optical fiber (e.g., 420a or 420b in Figure 4) and a redundant optical fiber (e.g., 420b or 420a in Figure 4) and access sections between said W-MULDEM unit and said individual ONUs are established by the extension of optical fibers (e.g., 460 in Figure 4), whereby downstream optical signals from said OSU to said ONUs and upstream optical signals from said ONUs to said OSU are multiplexed using wavelengths that are allocated to individual ONUs and the resultant signals are transmitted across said multiplexing section (the signals between the RN and CO are wavelength multiplexed signals), and whereby said W-MULDEM unit performs wavelength multiplexing or wavelength demultiplexing for said upstream or downstream optical signals to provide bidirectional transmission (Figure 4, the RN in Figure 4 provides wavelength multiplexing or wavelength demultiplexing for the upstream or downstream optical signals to provide bidirectional transmission), characterized in that:

the OSU includes transmission means (the central office transceiver COTs in Figure 4, or Lasers in Figures 26 and 28) for multiplexing downstream optical signals having wavelengths λd1 to λdn that correspond to said ONUs and that are to be transmitted to said ONUs along said current-use optical fiber (e.g., the 2815a in Figure 28), or along said redundant optical fiber (e.g., the 2815b in Figure 28), and for selecting (the switch 2828 in Figure 28) either said current-use optical fiber or said redundant optical fiber for use for transmission, and

reception means (the central office transceiver COTs in Figure 4, or Receivers in Figures 26 and 28) for receiving upstream optical signals having wavelengths λu1 to λun along said current-use optical fiber (e.g., the 2810a in Figure 28) or for receiving upstream optical signals having wavelengths λu1+Δλ to λun+Δλ along said redundant optical fiber (e.g., the 2810b in Figure 28);

the individual ONUs (the ONUs in Figure 4, or Figures 9-13, 18-23), receive corresponding downstream optical signals having wavelengths λd1 to λdn (e.g., Figure 29-34), or corresponding downstream optical signals which are received along said optical fibers extended across said access sections (Figure 4), the individual ONUs transmit (e.g., the Laser or Modulator in Figures 9-13, 18-23), to said optical fibers extended across said access sections (e.g., 440 in Figure 4, or 910 in Figure 9), corresponding upstream optical signals that have wavelengths λu1 to λun and are to be transmitted along said current-use optical fiber extended across said multiplexing section, or corresponding upstream optical signals that have wavelengths λu1+ Δλ to λun+Δλ and are to be transmitted along said redundant optical fiber (column 7, line 46-

51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path);

the W-MULDEM unit includes an array waveguide diffraction grating (AWG) having two ports (Figure 4, the RN is the wavelength grating router WGR or AWG, column 17 line 41-49, the RN in Figure 4 has two input ports and n output ports; note: the AWG is also known as WGR), which are to be respectively connected to said current-use optical fiber (e.g., 440a/420a in Figure 4) and said redundant optical fiber (e.g., 440b/420b in Figure 4), and n ports, which are to be connected to optical fibers corresponding to said ONUs (the ONUs 470 in Figure 4);

the W-MULDEM unit demultiplexes to said ports corresponding to said ONUs said downstream optical signals that have wavelengths $\lambda d1$ to λdn and are received along said current-use optical fiber (Figure 4, the RN demultiplexes the downstream optical signals that have wavelengths $\lambda d1$ to λdn and are received along the current-use optical fiber, e.g., 440a, to the ports corresponding to said ONUs), or said downstream optical signals that are received along said redundant optical fiber (e.g., the fiber 440b in Figure 4), or multiplexes, to said port corresponding to said current-use optical fiber or said redundant optical fiber (the RN multiplexes the signals from the ONUs and transmits the multiplexed signal to the CO via 440a/420a and/or 440b/420b in Figure 4), said upstream optical signals that have wavelengths $\lambda u1$ to λun or wavelengths $\lambda u1+ \Delta\lambda$ to $\lambda un+ \Delta\lambda$ and that are received along said optical fibers corresponding to said ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path).

But, Gnauck et al does not expressly disclose: (A) the OSU includes transmission means for multiplexing downstream optical signals having wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+ \Delta\lambda$ that correspond to said ONUs and that are to be transmitted to said ONUs along said redundant optical fiber; and ONUs can receive downstream signals having wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+ \Delta\lambda$ transmitted along the redundant optical fiber; and (B) the W-MULDEM unit demultiplexes said downstream optical signals that have wavelengths $\lambda d1+ \Delta\lambda$ to $\lambda dn+\Delta\lambda$ and are received along said redundant optical fiber; (C) a wavelength difference between said downstream optical signal and said upstream optical signal corresponding to each of said ONUs is integer times a free spectrum range (FSR) of said AWG;

In Figures 26 and 28, Gnauck et al teaches that the CO uses one set of transmitters/receivers for both the working path and protection path, and a switch is used to choose the fiber. Gnauck et al does not teaches two sets of transmitters/receivers.

With regard to items (A) and (B), however, to use separate transmitters for working path and protection path is well known and widely used in the art. Gerstel et al teaches two sets of transceivers/transponders for path protections (e.g., Figure 2(a) and Figure 4(a)). By using two sets of transceivers/transponders, the system can be more reliable and it can protect against transceiver/transponder failures. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use two sets of transceivers as taught by Gerstel et al to the system of Gnauck et al so that the multilayers of protection can be realized. Since the combination of Gnauck et

al and Gerstel et al teaches the separate transceivers for working paths and protection path, it is obvious that the protection transceivers can transmit another set of wavelengths, such as $\lambda d1+\Delta\lambda$ to $\lambda dn+\Delta\lambda$, which can be different from the wavelengths of the working path, to the redundant fiber (also, refer to Figure 9(a) of Gerstel et al), and then the W-MULDEM unit demultiplexes the downstream optical signals that have wavelengths $\lambda d1+\Delta\lambda$ to $\lambda dn+\Delta\lambda$ and are received along said redundant optical fiber.

With regard to item (C), Han et al, in the same field of endeavor, teaches a system and method for passive optical network in which the wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer time a free spectrum range (FSR) of the AWG (Figures 2 and 3, [0029]). As disclosed by Gnauck et al, the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (column 19, line 61-65, column 23 line 34-37).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the wavelength arrangement as taught by Han et al to the system of Gnauck et al and Gerstel et al so that one AWG/WGR can process two sets of signals and the upstream and downstream signals can be input/output through one port, and then the system can be simplified.

2). With regard to claim 3, Gnauck et al and Gerstel et al and Han et al discloses all of the subject matter as applied to claim 1 above. And Gnauck et al and Gerstel et al and Han et al further disclose when $\lambda d1$, $\lambda d2$, . . . and λdn are defined as wavelengths of downstream optical signals (e.g., Figure 26 of Gnauck et al; or Figure 3 of Hans) that

are transferred along said current-optical fiber and correspond to said ONUs, and when a wavelength interval is a constant, defining λd1+ k, λd2+k, . . . and λdn+k (k is an integer of one or greater to smaller than n) as wavelengths of downstream optical signals that are transferred along said redundant optical fiber to said ONUs (the protection transceivers can transmit another set of wavelengths, such as λd1+ Δλ to λdn+Δλ, which can be different from the wavelengths of the working path, to the redundant fiber), and

when λu1, λu2, . . . and λun are defined as wavelengths of upstream optical signals that are transferred along said current-optical fiber and correspond to said ONUs, and when a wavelength interval is a constant, defining λu1+k, λu2+k, . . . and λun+k (k is an integer of one or greater) as wavelengths of upstream optical signals that are transferred along said redundant optical fiber to said ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path).

3). With regard to claim 4, Gnauck et al and Gerstel et al and Han et al disclose all of the subject matter as applied to claim 1 above. But, Gnauck et al does not expressly disclose the system characterized by: replacing λdn+i with λdi when λdn+i=λdi+FSR is established; and replacing λun+i with λui when λun+i=λui+FSR is established (i is an integer of 1 to k).

However, since the combination of Gnauck et al and Gerstel et al and Han et al teach that the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (Gnauck et al: column 19, line 61-65, column 23 line 34-37) and

the wavelengths between the upstream and downstream channels can differ by FSR, it is obvious that the $\lambda dn+i$ can be replaced with λdi when $\lambda dn+i=\lambda di+FSR$ is established and the $\lambda un+i$ can be replaced with λui when $\lambda un+i=\lambda ui+FSR$ is established.

4). With regard to claim 7, Gnauck et al and Gerstel et al and Han et al disclose all of the subject matter as applied to claim 1 above. And Gnauck et al further discloses the optical wavelength division multiplexing access system characterized in that said OSU includes: means for individually detecting a transmission cutoff of downstream signals (column 30, line 37 to column 31 line 13, the CO provides both OTDR measurements and tracking system for individually detecting a transmission cutoff of downstream signals).

5). With regard to claim 46, Gnauck et al and Gerstel et al and Han et al disclose all of the subject matter as applied to claim 1 above. And Gnauck et al and Gerstel et al and Han et al further discloses the optical wavelength division multiplexing access system characterized by: allocating, for an arbitrary ONU, two wavelengths or more for a downstream current-use optical signal, a downstream reserve optical signal, an upstream current-use optical signal and an upstream reserve optical signal, so as to obtain a dual structure for optical fibers at said access sections (the combination of Gnauck et al and Gerstel et al and Han et al teaches two sets of transceivers in CO, so to allocate, for an arbitrary ONU, two or more wavelengths for the downstream current-use optical signal and the downstream reserve optical signal. And Gnauck also teaches that each ONU can use two wavelengths: one for current-use path, another for

redundant path, column 7, line 46-51; in Figure 23. A dual structure for optical fibers, 440a and 440b, at the access sections is also shown in Figure 4).

7. Claim 5, 6, 9, 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel and Han et al as applied to claim 1 above, and in further view of Darcie et al (US 5,907,417).

Gnauck et al and Gerstel and Han et al disclose all of the subject matter as applied to claim 1 above. And Gnauck et al further discloses that said OSU includes: switching means for changing from said upstream (or downstream) current-use optical fiber to said upstream (or downstream) redundant optical fiber (e.g., Figures 15, 17 and 28); and a supervisory control unit (the supervisory control unit must be present in the system so that the monitoring and switching is done smoothly, column 30, line 37 to column 31 line 13, the CO provides both OTDR measurements and tracking system), for detecting a transmission cutoff of upstream signals from said ONUs, and for transmitting a selection signal to said switching means, and when a transmission cutoff of all upstream optical signals is detected by said means that detects a transmission cutoff of upstream optical signals from said ONUs, said supervisory control unit performs a process for transmitting a selection signal (e.g., the control signal in Figure 28) to perform communication using said redundant optical fiber (column 30, line 37 to column 31 line 13); and when a transmission cutoff of a plurality of upstream optical signals is detected by said means that detects a transmission cutoff of upstream optical signals from said ONUs (the cutoff of a plurality of upstream optical signals can be detected and measured, column 30, line 37 to column 31 line 13), said supervisory

control unit performs a process for transmitting a selection signal (e.g., the control signal in Figure 28) to perform communication using said redundant optical fiber (column 30, line 37 to column 31 line 13).

But, Gnauck et al does not expressly state to collectively or individually detect a transmission cutoff of upstream signals from said ONUs.

However, as disclosed by Gnauck et al: the CO is adapted to poll a path under repair, to insure that the repair is being made properly, and that the proper fibers are being spliced together; also, such polling would be greatly simplified if each ONU was able to identify itself, so that the CO could confirm that the proper equipment was being connected. OTDR measurements could be made, and compared to previous OTDR measurements on file. That is the Gnauck et al's system can perform both collectively detection and individually detection of the transmission cutoff of upstream signals.

Another prior art, Darcie et al, in the same field of endeavor, also teaches a supervisory control unit for collectively or individually detecting a transmission cutoff of upstream signals from said ONUs (Figures 1-4). Darcie et al teaches that the network 10 may perform a diagnostic operation that determines the status of only upstream transmission. In this test, the diagnostic receiver 32 performs analysis using the upstream communication signals (that is, the signals from the ONUs can be analyzed collectively). And, the upstream communication signals contain distinct, interleaved spectral components, each spectral component corresponding to a particular ONU. The diagnostics receiver 32, which may suitably be a wavelength sensitive diagnostic device, such as an optical spectrum analyzer, analyzes the frequency content of the

multiplexed upstream communication signal to determine the status of the individual ONUs. Problems associated with a particular ONU's upstream transmission may be detected by examining the optical spectrum corresponding to the ONU, as determined by the WGR 100 in the remote node 22 (that is, the system can individually detect a transmission cutoff of upstream signals from said ONUs).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of fault detection as taught by Darcie et al to the system of Gnauck et al and Gerstel et al and Han et al so the fiber cut and ONU or other equipment failures can be detected and diagnosed accurately and rapidly.

8. Claims 12, 14, 18 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al (US H2075) in view of Gerstel et al (Gerstel et al: "Optical Layer Survivability-An Implementation Perspective", IEEE Journal on Selected Areas in Communications, Vol. 18, No. 10, October 2000, pages 1885-1899) and Akimoto et al (US 2003/0039010).

1). With regard to claim 12. Gnauck discloses an optical wavelength division multiplexing access system (e.g., Figures 3 and 4), whereby a center node (OSU) (the CO in Figures 3 and 4) and n optical network units (ONUs) (e.g., the ONUs in Figures 3 and 4) are arranged through a W-MULDEM unit (e.g., the AWG in RN in Figures 3 and 4), whereby a multiplexing section between said OSU and said W-MULDEM unit is established by extending a current-use downstream optical fiber (e.g., 2815a in Figure 28), a current-use upstream optical fiber (e.g., 2810a in Figure 28), a reserve

downstream optical fiber (e.g., 2815b in Figure 28) and a reserve upstream optical fiber (e.g., 2810b in Figure 28) and access sections between said W-MULDEM unit and said individual ONUs are established by the extension of downstream optical fibers (e.g., the fibers from ONUs to WGR in Figures 30-34) and of upstream optical fibers (e.g., the fibers from WGR to ONUs in Figures 30-34), whereby downstream optical signals from said OSU to said ONUs and upstream optical signals from said ONUs to said OSU are multiplexed, using wavelengths that are allocated to said individual ONUs, and resultant optical signals are transmitted across said multiplexing section (the signals between the RN and CO are wavelength multiplexed signals), and whereby said W-MULDEM unit performs either wavelength multiplexing or wavelength division for said upstream or downstream optical signals to provide bidirectional transmission (Figures 3 and 4, the RN provides wavelength multiplexing or wavelength demultiplexing for the upstream or downstream optical signals to provide bidirectional transmission), characterized in that:

the OSU includes

transmission means (the central office transceiver COTs in Figures 3 and 4, or Lasers in Figures 26 and 28) for multiplexing downstream optical signals having wavelengths $\lambda d1$ to λdn that correspond to said ONUs and that are to be transmitted to said ONUs along said current-use downstream optical fiber (e.g., the 2815a in Figure 28) or along said reserve downstream optical fiber (e.g., the 2815b in Figure 28), and for selecting (the switch 2828 in Figure 28) either said current-use downstream optical fiber or said reserve downstream optical fiber used for transmission, and

reception means (the central office transceiver COTs in Figure 4, or Receivers in Figures 26 and 28) for receiving upstream optical signals having wavelengths $\lambda u1$ to λun transmitted along said current-use upstream optical fiber (e.g., the 2810a in Figure 28), or for receiving upstream optical signals having wavelengths $\lambda u1+\Delta\lambda$ to $\lambda un+\Delta\lambda$ transmitted along said reserve upstream optical fiber (e.g., the 2810b in Figure 28);

the ONUs (the ONUs in Figures 3 and 4, or Figures 9-13, 18-23 and 30-34) receive, along said optical fibers extended across said access sections, corresponding downstream optical signals having wavelengths $\lambda d1$ to λdn (e.g., Figures 29-34) or corresponding downstream reserved optical signals, the ONUs transmit (e.g., the Laser or Modulator in Figures 9-13, 18-23 and 30-33), to said optical fibers extended across said access sections, corresponding upstream optical signals that have wavelengths $\lambda u1$ to λun and that are to be transmitted along said current-use optical fiber extended across said multiplexing section (e.g., the fibers between the WGR and ONUs in Figures 30-33), or corresponding upstream optical signals that have wavelengths $\lambda u1+\Delta\lambda$ to $\lambda un+\Delta\lambda$ and are to be transmitted along said redundant optical fiber (column 7, line 46-51; Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path);

the W-MULDEM unit includes

a downstream/upstream combined array waveguide diffraction grating (AWG) having four ports on one side (the RN is the wavelength grating router WGR or AWG, the RN in Figures 31, 33 and 34 has four ports on one side: two inputs and two outputs and 2n ports: n inputs and n outputs, n is the nuber of ONUs), which are to be

respectively connected to said current-use downstream optical fiber and said reserve downstream optical fiber (e.g., the fibers 3110 and 3120, 3310 and 3320 in Figures 31 and 33), and 2xn ports (e.g., the 2n ports connected to the ONUs in Figures 30-34), which are to be connected to optical fibers corresponding to said ONUs; and

the W-MULDEM unit demultiplexes to said ports of said downstream AWG that correspond to said ONUs said downstream optical signals that have wavelengths $\lambda d1$ to λdn (Figures 30-34, the RN demultiplexes the downstream optical signals that have wavelengths $\lambda d1$ to λdn and are received along the current-use optical fiber, e.g., 440a, to the ports corresponding to said ONUs) and are received along said current-use downstream optical fiber (e.g., the fiber 3120a in Figure 31 or 3310a in Figure 33), or said downstream optical signals that are received along said reserve downstream optical fiber (e.g., the fiber 3120b in Figure 31 or 3320b in Figure 33), or multiplexes, to said port corresponding to said current-use upstream optical fiber or said reserve upstream optical fiber, said upstream optical signals that have wavelengths $\lambda u1$ to λun or wavelengths $\lambda u1+ \Delta\lambda$ to $\lambda un+ \Delta\lambda$ and that are transmitted to said upstream AWG along said optical fibers corresponding to said ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path).

In Figures 31, 33 and 34, Gnauck et al shows a single AWG for both upstream and downstream transmissions, the WGR has four inputs on one side and 2n ports on the other side.

But, Gnauck et al does not expressly disclose: (A) the OSU includes transmission means for multiplexing downstream optical signals having wavelengths λd1+ Δλ to λdn+Δλ that correspond to said ONUs and that are to be transmitted to said ONUs along said reserve downstream optical fiber, and ONUs receive corresponding downstream optical signals having wavelengths λd1+ Δλ to λdn+Δλ; (B) two separate AWGs that performs downsteam signals and upstream signals, respectively.

With regard to item (A), however, to use separate transmitters for working path and protection path is well known and widely used in the art. Gerstel et al teaches two sets of transceivers/transponders for path protections (e.g., Figure 2(a) and Figure 4(a)). By using two sets of transceivers/transponders, the system can be more reliable and it can protect against transceiver/transponder failures. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use two sets of transceivers as taught by Gerstel et al to the system of Gnauck et al so that the multilayers of protection can be realized. Since the combination of Gnauck et al and Gerstel et al teaches the separate transceivers for working paths and protection path, it is obvious that the protection transceivers can transmit another set of wavelengths, such as λd1+ Δλ to λdn+Δλ, which can be different from the wavelengths of the working path, to the redundant fiber (also, refer to Figure 9(a) of Gerstel et al), and then the W-MULDEM unit demultiplexes the downstream optical signals that have wavelengths λd1+ Δλ to λdn+Δλ and are received along said redundant optical fiber and ONUs receive corresponding downstream optical signals having wavelengths λd1+ Δλ to λdn+Δλ.

With regard to item (B), although Gnauck et al doesn't specifically disclose the two separate AWG, such limitation are merely a matter of design choice and would have been obvious in the system of Gnauck et al; Gnauck et al teaches that the two downstream signals along the downstream working and protection paths are demultiplexed by the AWG and sent to the respective ONUs, and the upstream working and protection signals from the individual ONUs are multiplexed by the AWG and sent to the upstream working and protection paths. The limitations in claim 12 do not define a patentably distinct invention over that in Gnauck et al since both the invention as a whole and Gnauck et al are directed to mutiplex/demutiplex the upstream/downstream signals from/to individual fibers. Therefore, to use a single AWG for upstream/downstream or use two AWGs (one for upstream, another for downstream) would have been a matter of obvious design choice to one of ordinary skill in the art.

Also, another prior art, Akmoto et al, teaches a system in which two AWGs are used for upstream and downstream, respectively (e.g., 57-1 and 57-2 in Figures 4 and 5). In Figure 3, Gnauck et al also teaches that two separate RNs can be used to route the signals, and one RN failure does not impact another RN.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply two individual AWGs as taught by Akmoto et al to the system of Gnauck et al and Gerstel et al so that the system can be fully protected.

2). With regard to claim 14, Gnauck et al and Gerstel et al and Akimoto et al discloses all of the subject matter as applied to claim 12 above. And Gnauck et al and Gerstel et al and Akimoto et al further disclose when $\lambda d1$, $\lambda d2$, . . . and λdn are defined

as wavelengths of downstream optical signals (e.g., Figure 26 of Gnauck et al; or Figure 7 of Akimoto) that are transferred along said current-optical fiber and correspond to said ONUs, and when a wavelength interval is a constant, defining λd1+ k, λd2+k, . . . and λdn+k (k is an integer of one or greater to smaller than n) as wavelengths of downstream optical signals that are transferred along said redundant optical fiber to said ONUs (the protection transceivers can transmit another set of wavelengths, such as λd1+ $\Delta\lambda$ to λdn+$\Delta\lambda$, which can be different from the wavelengths of the working path, to the redundant fiber), and

when λu1, λu2, . . . and λun are defined as wavelengths of upstream optical signals that are transferred along said current-optical fiber and correspond to said ONUs, and when a wavelength interval is a constant, defining λu1+k, λu2+k, . . . and λun+k (k is an integer of one or greater) as wavelengths of upstream optical signals that are transferred along said redundant optical fiber to said ONUs (column 7, line 46-51; in Figure 23, Gnauck teaches that each ONU can use two wavelengths: one for current-use path, another for redundant path).

3). With regard to claim 18, Gnauck et al and Gerstel et al and Akimoto et al disclose all of the subject matter as applied to claim 14 above. And Gnauck et al further discloses the optical wavelength division multiplexing access system characterized in that said OSU includes: means for individually detecting a transmission cutoff of downstream signals (column 30, line 37 to column 31 line 13, the CO provides both OTDR measurements and tracking system for individually detecting a transmission cutoff of downstream signals).

4). With regard to claim 23, Gnauck et al and Gerstel et al and Akimoto et al disclose all of the subject matter as applied to claim 14 above. And Gnauck et al further discloses that wavelengths of downstream current-use optical signals that correspond to said ONUs are equalized with wavelengths of upstream current-use optical signals, and wavelengths of downstream reserve optical signals are equalized with wavelengths of upstream reserve optical signals (in Figure 19, the partial of the downstream signals are modulated by the modulator 1960 and then transmitted the signals having the same wavelength back to the CO). Also, since the combination of Gnauck et al and Gerstel et al and Akimoto et al teaches two sets of transmitters, two RNs and two upstream fibers and two downstream fibers, therefore, it is obvious that that the wavelengths of downstream and upstream signals can be equalized, and wavelengths of downstream reserve optical signals can be equalized with wavelengths of upstream reserve optical signals since these signals are transmitted via different fibers and no interferences between the different signals.

9. Claims 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel et al and Akimoto et al as applied to claims 12 and 14 above, and in further view of Han et al (US 2004/0213574).

Gnauck et al and Gerstel et al and Akimoto et al disclose all of the subject matter as applied to claim 12 above. But, Gnauck et al does not expressly disclose the system characterized by: replacing $\lambda dn+i$ with λdi when $\lambda dn+i=\lambda di+FSR$ is established; and replacing $\lambda un+i$ with λui when $\lambda un+i=\lambda ui+FSR$ is established (i is an integer of 1 to k).

However, Han et al, in the same field of endeavor, teaches a system and method for passive optical network in which the wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer time a free spectrum range (FSR) of the AWG (Figures 2 and 3, [0029]). As disclosed by Gnauck et al, the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (column 19, line 61-65, column 23 line 34-37).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the wavelength arrangement as taught by Han et al to the system of Gnauck et al and Gerstel et al and Akimoto et al so that the AWG can process multiple sets of signals and the $\lambda dn+i$ can be replaced with λdi when $\lambda dn+i=\lambda di+FSR$ is established and the $\lambda un+i$ can be replaced with λui when $\lambda un+i=\lambda ui+FSR$ is established; and the system can be simplified.

10. Claims 16, 17 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel et al and Akimoto et al as applied to claims 12 above, and in further view of Darcie et al (US 5,907,417).

Gnauck et al and Gerstel and Akimoto et al disclose all of the subject matter as applied to claim 12 above. And Gnauck et al further discloses the optical wavelength division multiplexing access system, characterized in that said OSU includes: switching means for changing from said upstream (or downstream) current-use optical fiber to said upstream (or downstream) redundant optical fiber (e.g., Figures 15, 17 and 28); and a supervisory control unit (the supervisory control unit must be present in the system so that the monitoring and switching is done smoothly, column 30, line 37 to

column 31 line 13, the CO provides both OTDR measurements and tracking system), for detecting a transmission cutoff of upstream signals from said ONUs, and for transmitting a selection signal to said switching means, and when a transmission cutoff of all upstream optical signals is detected by said means that detects a transmission cutoff of upstream optical signals from said ONUs, said supervisory control unit performs a process for transmitting a selection signal (e.g., the control signal in Figure 28) to perform communication using said redundant optical fiber (column 30, line 37 to column 31 line 13).

But, Gnauck et al does not expressly state to collectively or individually detect a transmission cutoff of upstream signals from said ONUs.

However, as disclosed by Gnauck et al: the CO is adapted to poll a path under repair, to insure that the repair is being made properly, and that the proper fibers are being spliced together; also, such polling would be greatly simplified if each ONU was able to identify itself, so that the CO could confirm that the proper equipment was being connected. OTDR measurements could be made, and compared to previous OTDR measurements on file. That is the Gnauck et al’s system can perform both collectively detection and individually detection of the transmission cutoff of upstream signals.

Another prior art, Darcie et al, in the same field of endeavor, also teaches a supervisory control unit for collectively or individually detecting a transmission cutoff of upstream signals from said ONUs (Figures 1-4). Darcie et al teaches that the network 10 may perform a diagnostic operation that determines the status of only upstream transmission. In this test, the diagnostic receiver 32 performs analysis using the

upstream communication signals (that is, the signals from the ONUs can be analyzed collectively). And, the upstream communication signals contain distinct, interleaved spectral components, each spectral component corresponding to a particular ONU. The diagnostics receiver 32, which may suitably be a wavelength sensitive diagnostic device, such as an optical spectrum analyzer, analyzes the frequency content of the multiplexed upstream communication signal to determine the status of the individual ONUs. Problems associated with a particular ONU's upstream transmission may be detected by examining the optical spectrum corresponding to the ONU, as determined by the WGR 100 in the remote node 22 (that is, the system can individually detect a transmission cutoff of upstream signals from said ONUs).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the technique of fault detection as taught by Darcie et al to the system of Gnauck et al and Gerstel et al and Akimoto et al so the fiber cut and ONU or other equipment failures can be detected and diagnosed accurately and rapidly.

11. Claims 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gnauck et al and Gerstel et al and Akimoto et al as applied to claim 12 above, and in further view of Han et al (US 2004/0213574).

Gnauck et al and Gerstel and Akimoto et al disclose all of the subject matter as applied to claim 12 above. And Gnauck et al and Gerstel and Akimoto et al further disclose that said OSU includes

means for oscillating optical carriers (e.g., the C band light source in Figure 2, or 1163 in Figure 21 of Akimoto) having wavelengths $\lambda u1$ to λun, which are used for upstream signals, so as to permit said ONUs to generate upstream optical signals, and for multiplexing said optical carriers and transmitting a resultant carrier to said downstream current-use optical fiber, and

said ONUs include

means (e.g., the modulator 1172 in Figure 21 of Akimoto) for modulating corresponding optical carriers, used for upstream signals, from among those that are received while multiplexed with downstream optical signals, and transmitting thereby obtained signals as upstream optical signals having wavelengths $\lambda u1$ to λun (Figure 21) or wavelengths $\lambda u1+ \Delta\lambda u$ to $\lambda un+ \Delta\lambda u$; and

said downstream AWG provided for said W-MULDEM unit is so constituted as to separate, at the same time, said downstream optical signals and said optical carriers, used for upstream signals, which correspond to said ONUs (the AWG in Figure 21 separate the downstream optical signals and the optical carriers used for upstream signals, to respective ONUs).

But, Gnauck et al and Gerstel and Akimoto et al do not expressly disclose: (A) means for oscillating optical carriers having wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$, which are used for upstream signals, so as to permit said ONUs to generate upstream optical signals, and for multiplexing said optical carriers and transmitting a resultant carrier to said downstream redundant optical fiber; (B) a wavelength difference between said downstream optical signals and said upstream optical signals corresponding to said

ONUs is defined as integer times a free spectrum range (FRS) of said downstream AWG.

With regard t item (A), the combination of Gnauck et al and Gerstel and Akimoto et al teaches a working system and a protection system, and Akimoto et al teaches means for oscillating optical carriers for working system, therefore, it is obvious to one skilled in the art also apply another means for oscillating optical carriers having wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$, which are used for upstream signals to the system of Gnauck et al and Gerstel and Akimoto et al, so as to permit said ONUs to generate upstream optical signals, and for multiplexing said optical carriers and transmitting a resultant carrier to said downstream redundant optical fiber.

With regard to item (B), Han et al, in the same field of endeavor, teaches a system and method for passive optical network in which the wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer times a free spectrum range (FSR) of the AWG (Figures 2 and 3, [0029]). As disclosed by Gnauck et al, the wavelengths and the WGR must be carefully configured to ensure the signal transmissions (column 19, line 61-65, column 23 line 34-37).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the wavelength arrangement as taught by Han et al to the system of Gnauck et al and Gerstel et al and Akimoto et al so that one AWG/WGR can process multiple sets of signals, and then signal routing can be made easier and the system can be simplified.

Allowable Subject Matter

12. Claims 2, 8, 13, 19, 25 and 29-39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. Claims 26-28 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

14. Claim 42 would be allowable if rewritten or amended to overcome the objection set forth in this Office action.

15. Claims 40, 41 and 43-45 are allowed.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tervonen et al (US 2005/0036785);

Eijk et al (US 6,868,232);

Kumozaki et al (US 5,539,564);

Lee et al (US 2003/0142978).

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Li Liu
March 16, 2008

/Kenneth N Vanderpuye/
Supervisory Patent
Examiner, Art Unit 2613